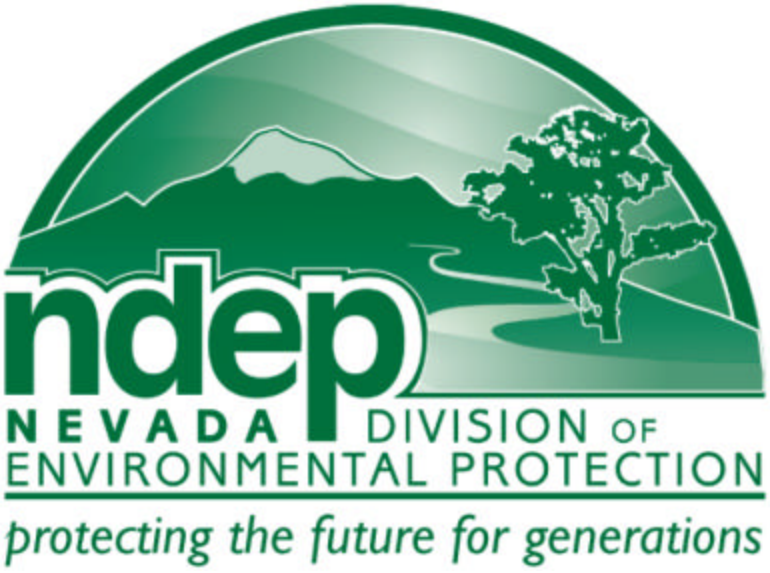
Student Workbook

Module 3



Solid Waste & Recycling Curriculum

Module 3

Industrial Strength

Heavy Duty Recycling

Industrial Strength

Lesson 15 – **Pulp Non-Fiction**
Industrial Paper Recycling

Lesson 16 – **Solid Steel**
Aluminum and Steel Recycling

Lesson 17 – **Recycle, For PETE's Sake**
Plastic Recycling

Lesson 18 – **2800 Degrees Fahrenheit**
Glass Recycling
(and Mercury exposure)

Lesson 19 – **Socrates Static**
Oral Assessment: Debate

Lesson 20 – **Socrates Static**
Oral Assessment: Debate

Solid Waste and Recycling Curriculum **Name:_____**

Lesson 15

Pulp Non-Fiction

Date:_____

Objectives:	I will define key vocabulary. I will summarize and present the paper recycling process to the class.

Vocabulary

Pulp:

De-inking:

Floatation:

Refining:

Virgin Fiber:

Group 1

The following material is quoted directly from EarthAnswers_Recycle.pdf. The text was generated by TAPPI and can be found by following the link below:
http://www.tappi.org/paperu/all_about_paper/earth_answers/earthAnswers.htm

Sorting

Successful recycling requires clean recovered paper, so you must keep your paper free from contaminants, such as food, plastic, metal, and other trash, which make paper difficult to recycle. Contaminated paper which cannot be recycled must be composted, burned for energy, or landfilled.

Recycling centers usually ask that you sort your paper by grade, or type of paper. Your local recycling center can tell you how to sort paper for recycling in your community. To locate your nearest dealer, look in the yellow pages of your phone book under "waste paper" or "recycling."

Collection and Transportation

You may take your sorted paper to a local recycling center or recycling bin. Often, a paper stock dealer or recycling center will collect recovered paper from your home or office. Your local dealer can tell you the options available in your community.

At the recycling center, the collected paper is wrapped in tight bales and transported to a paper mill, where it will be recycled into new paper.

Group 2

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Storage

Paper mill workers unload the recovered paper and put it into warehouses, where it is stored until needed. The various paper grades, such as newspapers and corrugated boxes, are kept separate, because the paper mill uses different grades of recovered paper to make different types of recycled paper products.

When the paper mill is ready to use the paper, forklifts move the paper from the warehouse to large conveyors.

Re-pulping and Screening

The paper moves by conveyor to a big vat called a pulper, which contains water and chemicals. The pulper chops the recovered paper into small pieces. Heating the mixture breaks the paper down more quickly into tiny strands of cellulose (organic plant material) called fibers. Eventually, the old paper turns into a mushy mixture called pulp.

The pulp is forced through screens containing holes and slots of various shapes and sizes. The screens remove small contaminants such as bits of plastic and globs of glue. This process is called screening.

Group 3

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Cleaning

Mills also clean pulp by spinning it around in large cone-shaped cylinders. Heavy contaminants like staples are thrown to the outside of the cone and fall through the bottom of the cylinder. Lighter contaminants collect in the center of the cone and are removed. This process is called cleaning.

Deinking

Sometimes the pulp must undergo a "pulp laundering" operation called deinking (de-inking) to remove printing ink and "stickies" (sticky materials like glue residue and adhesives). Papermakers often use a combination of two deinking processes. Small particles of ink are rinsed from the pulp with water in a process called washing. Larger particles and stickies are removed with air bubbles in another process called flotation. During flotation deinking, pulp is fed into a large vat called a flotation cell, where air and soap-like chemicals call surfactants are injected into the pulp. The surfactants cause ink and stickies to loosen from the pulp and stick to the air bubbles as they float to the top of the mixture. The inky air bubbles create foam or froth which is removed from the top, leaving the clean pulp behind.

Group 4

The following material is quoted directly from EarthAnswers_Recycle.pdf. The text was generated by TAPPI and can be found by following the link below:
http://www.tappi.org/paperu/all_about_paper/earth_answers/earthAnswers.htm

Refining, Bleaching and Color Stripping

During refining, the pulp is beaten to make the recycled fibers swell, making them ideal for papermaking. If the pulp contains any large bundles of fibers, refining separates them into individual fibers. If the recovered paper is colored, color stripping chemicals remove the dyes from the paper.

Then, if white recycled paper is being made, the pulp may need to be bleached with hydrogen peroxide, chlorine dioxide, or oxygen to make it whiter and brighter. If brown recycled paper is being made, such as that used for industrial paper towels, the pulp does not need to be bleached.

Papermaking

Now the clean pulp is ready to be made into paper. The recycled fiber can be used alone, or blended with new wood fiber (called virgin fiber) to give it extra strength or smoothness.

The pulp is mixed with water and chemicals to make it 99.5% water. This watery pulp mixture enters the headbox, a giant metal box at the beginning of the paper machine, and then is sprayed in a continuous wide jet onto a huge flat wire screen which is moving very quickly through the paper machine.

Group 5

The following material is quoted directly from EarthAnswers_Recycle.pdf. The text was generated by TAPPI and can be found by following the following link: http://www.tappi.org/paperu/all_about_paper/earth_answers/earthAnswers.htm

Papermaking (cont.)

On the screen, water starts to drain from the pulp, and the recycled fibers quickly begin to bond together to form a watery sheet. The sheet moves rapidly through a series of felt-covered press rollers which squeeze out more water.

The sheet, which now resembles paper, passes through a series of heated metal rollers which dry the paper. If coated paper is being made, a coating mixture can be applied near the end of the process, or in a separate process after the papermaking is completed. coating gives paper a smooth, glossy surface for printing.

Finally, the finished paper is wound into a giant roll and removed from the paper machine. One roll can be as wide as 30 feet and weigh as much as 20 tons! The roll of paper is cut into smaller rolls, or sometimes into sheets, before being shipped to a converting plant where it will be printed or made into products such as envelopes, paper bags, or boxes.

Group 6

The following material is quoted directly from EarthAnswers_Recycle.pdf. The text was generated by TAPPI and can be found by following the link below:
http://www.tappi.org/paperu/all_about_paper/earth_answers/earthAnswers.htm

Can all of my recovered paper be recycled?

As much as 80% of the content of typical recovered paper can actually be used in the recycling process, but 20% cannot. A lot of what's contained in a bale of recovered "paper" isn't paper! Trash, such as wire, staples, paper clips, and plastic, must be removed during pulping, cleaning, and screening. This trash is usually sent to a landfill, just like your trash at home.

Recovered paper contains some fibers which have become too small to be recycled into paper. Your recovered paper may contain fibers which already have been recycled one [*sic*], twice, or perhaps several times! Wood fibers can only be recycled five to seven times before they become too short and brittle to be made into new paper.

Recovered paper contains many other ingredients which are not paper fibers. Just take a look at a magazine and you'll see what we mean. The printed pages contain lots of ink. If the pages are shiny, that portably [*sic*] means they are coated with clay or other materials. Magazines also contain adhesives which bind the pages together. Ink, coatings, and adhesives must be removed from the paper before recycled paper can be produced.

Group 7

The following material is quoted directly from EarthAnswers_Recycle.pdf. The text was generated by TAPPI and can be found by following the following link: http://www.tappi.org/paperu/all_about_paper/earth_answers/earthAnswers.htm

What can be made from recovered paper?

Most recovered paper is recycled back into paper and paperboard products. With a few exceptions, recovered paper is generally recycled into a grade similar to, or of lower quality than, the grade of the original product. For example, old corrugated boxes are used to make new recycled corrugated boxes. Recovered printing and writing paper can be used to make new recycled copy paper.

Recovered paper can be used in a variety of other products as well. Recycled pulp can be molded into egg cartons and fruit trays. Recovered paper can be used for fuel, ceiling and wall insulation, paint filler, and roofing. Nearly 100,000 tons of shredded paper is used each year for animal bedding. Even cat litter can be made from recovered paper!

Solid Waste and Recycling Curriculum **Name:_____**

Lesson 16

Solid Steel

Date:_____

Objectives: I will able to identify aluminum and steel cans.
I will know how to recycle cans in Northern Nevada.
I will compose a poem, song, or other performance piece about metal cans.

Aluminum	Tin (99% Steel)

Performance Piece

Please write draft of your performance piece here.

Solid Waste and Recycling Curriculum **Name:_____**

Lesson 17

Recycle, For PETE's Sake **Date:_____**

Objectives:	I will know there are different types of plastic. I will complete a chart containing the characteristics of different plastics. I will answer questions about plastic based on their completed chart.

1. There are 2 types of plastic that are picked up by the curbside recycling program in Northern Nevada. What are they? (You can give their resin code or the scientific name).

2. There is another location, besides curbside, to take these two plastics for recycling. What is it called?

3. Plastic 2, HDPE, is also commonly used to make grocery bags. Where can you take grocery bags for recycling?

4. What type of plastic is used to make ice scrapers?

5. Is this plastic recyclable in Northern Nevada?

6. Which plastic is recycled into insulation?

7. List one of the products made with recycled plastic 7.

8. List 3 properties of plastic 4, LDPE.

Solid Waste and Recycling Curriculum **Name:_____**

Lesson 17

Recycle, For PETE's Sake **Date:_____**

Recycling in Northern Nevada			
Recycled Products			
Examples			
Properties			
Scientific Name			
Resin Code			

Solid Waste and Recycling Curriculum **Name:_____**

Lesson 17

Recycle, For PETE's Sake **Date:_____**

Recycling in Northern Nevada			
Recycled Products			
Examples			
Properties			
Scientific Name			
Resin Code			

Solid Waste and Recycling Curriculum **Name:_____**

Lesson 17

Recycle, For PETE's Sake **Date:_____**

Recycling in Northern Nevada			
Recycled Products			
Examples			
Properties			
Scientific Name			
Resin Code			

Solid Waste and Recycling Curriculum **Name:_____**

Lesson 18

2800 Degrees Fahrenheit **Date:_____**

Objectives:	I will examine facts about glass recycling. I will be exposed to facts about proper mercury disposal. I will translate text into test questions.

Please write 2 test questions and answers from page M3-68.

1.

2.

GLASS Clear Facts

Glass containers are an environmentally superior packaging—nontoxic, high value, and completely recyclable.

100% recyclable

- Glass can be recycled again and again with no loss in quality or purity. Glass containers go from recycling bin to store shelf in as little as 30 days—again and again.
- In 2005, glass made up 5.2% of the municipal solid waste stream by weight, and of that, 25.3% of glass containers were recycled.
-

The environmental choice

- Made from domestically plentiful, nontoxic raw materials—silica, sand, soda ash, limestone and up to 70% recycled glass—glass is one of the safest packaging materials.
- And, recycling glass reduces consumption of raw materials, extends the life of plant equipment, such as furnaces, and saves energy.
-

Superior, light-weight packaging

Today's glass containers are also more than 40% lighter than they were 20 years ago.

This document was taken directly from
http://www.gpi.org/recycling/faq/

2800 Degrees Fahrenheit **Date:_____**

Please write 2 test questions and answers from page M3-70.

1.

2.

2800 Degrees Fahrenheit

Date:_____

Q. HOW ARE GLASS BOTTLES AND JARS MADE?

A. Glass is made from readily-available domestic materials, such as sand, soda ash, limestone and "cullet," the industry term for furnace-ready scrap glass. The only material used in greater volumes than cullet is sand. These materials are mixed, or "batched," heated to a temperature of 2600 to 2800 degrees Fahrenheit and molded into the desired shape.

Q. HOW DOES RECYCLING FIT INTO THE MANUFACTURING PROCESS?

A. Recycled glass is substituted for up to 70% of raw materials. Manufacturers benefit from recycling in several ways—it reduces emissions and consumption of raw materials, extends the life of plant equipment, such as furnaces, and saves energy.

Q. WHY IS MORE RECYCLED CONTAINER GLASS NEEDED?

A. Because glass manufacturers require high-quality recycled container glass to meet market demands for new glass containers. Cullet is always part of the recipe for glass, and the more that is used, the greater the decrease in energy used in the furnace. This makes using cullet profitable in the long run, lowering costs for glass container manufacturers—and benefiting the environment.

This document was taken directly from
http://www.gpi.org/recycling/faq/

Solid Waste and Recycling Curriculum **Name:_____**

Lesson 18

2800 Degrees Fahrenheit **Date:_____**

Please write 2 test questions and answers from page M3-72.

1.

2.

Q. WHAT TYPES OF GLASS CAN BE RECYCLED? WHAT ARE THE INDUSTRY STANDARDS FOR CULLET?

A. Glass containers, such as those for food and beverages, can be recycled. Other types of glass, like windows, ovenware, Pyrex, crystal, etc. are manufactured through a different process. If these materials are introduced into the manufacturing process, they can cause production problems and defective containers.

Furnace-ready cullet must also be free of contaminants such as metals, ceramics, gravel, stones, etc. Color sorting makes a difference, too. Glass manufacturers are limited in the amount of mixed cullet they can use to manufacture new containers. Separating recycled container glass by color allows the industry to ensure that new bottles match the color standards required by glass container customers.

Q. IS THERE A WAY TO REUSE GLASS THAT CONTAINER MANUFACTURERS CAN'T ACCEPT?

A. Cullet that doesn't meet container manufacturing standards and non-container glass are used in tile, filtration, sand blasting, concrete pavements and parking lots, decorative items, and fiber glass.

This document was taken directly from
http://www.gpi.org/recycling/faq/

Solid Waste and Recycling Curriculum **Name:_____**

Lesson 18

2800 Degrees Fahrenheit **Date:_____**

Please write 2 test questions and answers from page M3-74.

1.

2.

Solid Waste and Recycling Curriculum **Name:_____**

Lesson 18

2800 Degrees Fahrenheit **Date:_____**

Mercury is a metal. It is the only metal that is liquid at room temperature.

Mercury can be absorbed through the skin.

Because mercury can become a gas at room temperature, you must also be careful not to breathe in the mercury gas.

How to Handle a Small Mercury Spill

Tell a responsible adult.

Do not play with it.

Open windows and doors that vent to the outdoors.

Immediately remove children from the area.

If unsure of what to do at anytime during the spill call the NDEP Spill Reporting Hotline at 888-331-6637.

For all other mercury disposal concerns contact the Recycling Hotline at 1-800-597-5865

Ever wonder where the term "mad as a hatter" came from?

Mercury, was once used in the hat making process. It caused a brain illness in many hatters. Mercury removed fur from pelts to turn it into felt more easily. Hat makers began to experience its effects on their nervous systems. Doctors even recorded seeing "holes the size of quarters" inside some hatters' brains.

Information taken directly from Nevada Division of Environmental Protection's informational brochure about mercury.

2800 Degrees Fahrenheit **Date:_____**

Please write 2 test questions and answers from page M3-76.

1.

2.

Mercury Containing Products

Batteries

Certain alkaline batteries prior to 1998
Button batteries

Measuring Devices

Thermometers
Thermostats
Barometers
Manometers
Certain switches

Lighting

Fluorescent lamps
Mercury vapor lamps
High-pressure sodium lamps
Metal halide lamps & neon lamps
Strobe lights.

Dental Amalgam

Mercury is used in dental fillings because it is durable, inexpensive and able to bond with some metals.
Alternative fillings are made of gold, porcelain, ceramic or plastics.

Historical Uses

Certain pigments of latex and oil-based paints pre 1991
Pesticides / fungicides
Felt hat manufacturing

Information taken directly from Nevada Division of Environmental Protection's informational brochure about mercury.

2800 Degrees Fahrenheit **Date:_____**

Notes from discussion with partner.

Any new questions?

2800 Degrees Fahrenheit

Date:_____

Solid Waste and Recycling Curriculum **Name:_____**

Lesson 19

Socrates Static **Date:_____**

Objectives: I will participate in an academic debate.
I will work in groups to prepare for the debate.
I will review and use information presented in this class.

Socrates Static-- Debate Rubric

	0	Needs Work 1	Approaching Expectations 2	Meets Expectations 3
Respect for Other Team	Statements, responses and/or body language were consistently not respectful.	Most statements and responses were respectful and in appropriate language, but there was one sarcastic remark.	Statements and responses were respectful and used appropriate language, but once or twice body language was not.	All statements, body language, and responses were respectful and were in appropriate language.
Information	Information had several inaccuracies OR was usually not clear.	Most information presented in the debate was clear and accurate, but was not usually thorough.	Most information presented in the debate was clear, accurate and thorough.	All information presented in the debate was clear, accurate and thorough.
Rebuttal	Counter-arguments were not accurate and/or relevant	Most counter-arguments were accurate and relevant, but several were weak.	Most counter-arguments were accurate, relevant, and strong.	All counter-arguments were accurate, relevant and strong.

Socrates Static -- Debate Rubric

	0	Needs Work 1	Approaching Expectations 2	Meets Expectations 3
Use of Facts/Statistics	Every point was not supported.	Every major point was supported with facts, statistics and/or examples, but the relevance of some points were questionable.	Every major point was adequately supported with relevant facts, statistics and/or examples.	Every major point was well supported with several relevant facts, statistics and/or examples.
Presentation Style	One or more members of the team had a presentation style that did not keep the attention of the audience.	Team sometimes used gestures, eye contact, tone of voice and a level of enthusiasm in a way that kept the attention of the audience.	Team usually used gestures, eye contact, tone of voice and a level of enthusiasm in a way that kept the attention of the audience.	Team consistently used gestures, eye contact, tone of voice and a level of enthusiasm in a way that kept the attention of the audience.
Organization	Arguments were not clearly tied to an idea (premise).	All arguments were clearly tied to an idea (premise) but the organization was sometimes not clear or logical.	Most arguments were clearly tied to an idea (premise) and organized in a tight, logical fashion.	All arguments were clearly tied to an idea (premise) and organized in a tight, logical fashion.
Understanding of Topic	The team did not show an adequate understanding of the topic.	The team seemed to understand the main points of the topic and presented those with ease.	The team clearly understood the topic in-depth and presented their information with ease.	The team clearly understood the topic in-depth and presented their information forcefully and convincingly.

Socrates Static **Date:_____**

Topic

I want to start a recycling program at your school. There are some people that agree with me and some who say a recycling program is a waste of time.

Team A:

Argue that a recycle program is a good idea. Include reasons why we should start one and how we might set up a program. Use facts that you have learned from this class.

Team B:

Argue that a recycle program is a waste of time and resources. Include reasons why a recycle program not be set up at your school. Use facts and opinions based on what you have leaned from this class.

Initial Arguments

Solid Waste and Recycling Curriculum **Name:_____**

Lesson 19

Socrates Static **Date:_____**

Counter-argument

Socrates Static-- Debate Rubric

Team Score

	SCORE
Respect for Other Team	
Information	
Rebuttal	
Use of Facts/Statistics	
Presentation Style	
Organization	
Understanding of Topic	

Total points earned:	Total possible: **21**	Percent:

Solid Waste and Recycling Curriculum **Name:_____**

Lesson 20

Socrates Static: Day 2 **Date:_____**

Objectives: I will participate in an academic debate.
I will work in groups to prepare for the debate.
I will review and use information presented in this class.

Socrates Static-- Debate Rubric

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Respect for Other Team	Statements, responses and/or body language were consistently not respectful.	Most statements and responses were respectful and in appropriate language, but there was one sarcastic remark.	Statements and responses were respectful and used appropriate language, but once or twice body language was not.	All statements, body language, and responses were respectful and were in appropriate language.
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Solid Waste and Recycling Curriculum **Name:_____**

Lesson 20

Socrates Static: Day 2 **Date:_____**

Socrates Static-- Debate Rubric

	0	Needs Work 1	Approaching Expectations 2	Meets Expectations 3
Use of Facts/Statistics	Every point was not supported.	Every major point was supported with facts, statistics and/or examples, but the relevance of some points were questionable.	Every major point was adequately supported with relevant facts, statistics and/or examples.	Every major point was well supported with several relevant facts, statistics and/or examples.
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Solid Waste and Recycling Curriculum **Name:_____**

Lesson 20

Socrates Static: Day 2 **Date:_____**

Topic

I want to start a recycling program at your school. There are some people that agree with me and some who say a recycling program is a waste of time.

Team A:

Argue that a recycle program is a waste of time and resources. Include reasons why a recycle program not be set up at your school. Use facts and opinions based on what you have leaned from this class.

Team B:

Argue that a recycle program is a good idea. Include reasons why we should start one and how we might set up a program. Use facts that you have learned from this class.

Solid Waste and Recycling Curriculum **Name:_____**

Lesson 20

Socrates Static: Day 2 **Date:_____**

Initial Arguments

Socrates Static: Day 2 **Date:_____**

Counter-argument

Solid Waste and Recycling Curriculum **Name:_____**

Lesson 20

Socrates Static: Day 2 **Date:_____**

Socrates Static-- Debate Rubric

Team Score

	SCORE
Respect for Other Team	
Information	
Rebuttal	
Use of Facts/Statistics	
Presentation Style	
Organization	
Understanding of Topic	

Total points earned:	Total possible: **21**	Percent: